

INSECTA MUNDI

A Journal of World Insect Systematics

0206

The apterous endemic genus *Omphra* Dejean (Coleoptera: Carabidae: Helluonini) of the Indian subcontinent: taxonomy with notes on habits and distributional patterns

Shiju T. Raj

Post Graduate and Research Department of Zoology
The New College, Royapettah
Chennai-670014, Tamil Nadu, INDIA
shijutraaj@gmail.com

Thomas K. Sabu

Litter Entomology Research Unit
Post Graduate and Research Department of Zoology
St. Joseph's College, Devagiri
Calicut-673008, Kerala, INDIA
sabukthomas@gmail.com

Zhao Danyang

Department of Entomology
College of Natural Resources and Environment
South China Agricultural University, Wushan
Guangzhou-510640, CHINA

Date of Issue: February 29, 2012

Shiju T. Raj, Thomas K. Sabu and Zhao Danyang

The apterous endemic genus *Omphra* Dejean (Coleoptera: Carabidae: Helluonini) of the Indian subcontinent: taxonomy with notes on habits and distribution patterns
Insecta Mundi 0206: 1-15

Published in 2012 by

Center for Systematic Entomology, Inc.

P. O. Box 141874

Gainesville, FL 32614-1874 U. S. A.

<http://www.centerforsystematicentomology.org/>

Insecta Mundi is a journal primarily devoted to insect systematics, but articles can be published on any non-marine arthropod. Topics considered for publication include systematics, taxonomy, nomenclature, checklists, faunal works, and natural history. **Insecta Mundi** will not consider works in the applied sciences (i.e. medical entomology, pest control research, etc.), and no longer publishes book reviews or editorials. **Insecta Mundi** publishes original research or discoveries in an inexpensive and timely manner, distributing them free via open access on the internet on the date of publication.

Insecta Mundi is referenced or abstracted by several sources including the Zoological Record, CAB Abstracts, etc. **Insecta Mundi** is published irregularly throughout the year, with completed manuscripts assigned an individual number. Manuscripts must be peer reviewed prior to submission, after which they are reviewed by the editorial board to ensure quality. One author of each submitted manuscript must be a current member of the Center for Systematic Entomology.

Managing editor: Paul E. Skelley, e-mail: insectamundi@gmail.com

Production editor: Michael C. Thomas, Ian Stocks, Brian Armitage

Editorial board: J. H. Frank, M. J. Paulsen

Subject editors: G.B. Edwards, J. Eger, A. Rasmussen, F. Shockley, G. Steck, Ian Stocks, A. Van Pelt, J. Zaspel

Spanish editors: Julieta Brambila, Angélico Asenjo

Printed copies (ISSN 0749-6737) deposited in libraries of:

CSIRO, Canberra, ACT, Australia

Museu de Zoologia, São Paulo, Brazil

Agriculture and Agrifood Canada, Ottawa, ON, Canada

The Natural History Museum, London, Great Britain

Muzeum i Instytut Zoologiczny PAN, Warsaw, Poland

National Taiwan University, Taipei, Taiwan

California Academy of Sciences, San Francisco, CA, USA

Florida Department of Agriculture and Consumer Services, Gainesville, FL, USA

Field Museum of Natural History, Chicago, IL, USA

National Museum of Natural History, Smithsonian Institution, Washington, DC, USA

Zoological Institute of Russian Academy of Sciences, Saint-Petersburg, Russia

Electronic copies (On-Line ISSN 1942-1354, CDROM ISSN 1942-1362) in PDF format:

Printed CD mailed to all members at end of year.

Florida Center for Library Automation: <http://purl.fcla.edu/fcla/insectamundi>

University of Nebraska-Lincoln, Digital Commons: <http://digitalcommons.unl.edu/insectamundi/>

Goethe-Universität, Frankfurt am Main: <http://edocs.ub.uni-frankfurt.de/volltexte/2010/14363/>

Author instructions available on the *Insecta Mundi* page at:

<http://www.centerforsystematicentomology.org/insectamundi/>

Copyright held by the author(s). This is an open access article distributed under the terms of the Creative Commons, Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original author(s) and source are credited. <http://creativecommons.org/licenses/by-nc/3.0/>

The apterous endemic genus *Omphra* Dejean (Coleoptera: Carabidae: Helluonini) of the Indian subcontinent: taxonomy with notes on habits and distributional patterns

Shiju T. Raj

Post Graduate and Research Department of Zoology
The New College, Royapettah
Chennai-670014, Tamil Nadu, INDIA
shijutraj@gmail.com

Thomas K. Sabu

Litter Entomology Research Unit
Post Graduate and Research Department of Zoology
St. Joseph's College, Devagiri
Calicut-673008, Kerala, INDIA
sabukthomas@gmail.com

Zhao Danyang

Department of Entomology
College of Natural Resources and Environment
South China Agricultural University, Wushan
Guangzhou-510640, CHINA

Abstract. Among the four oriental genera of the tribe Helluonini, *Omphra* Dejean (Coleoptera: Carabidae), is unique for its endemism to the Indian subcontinent and aptery. High intraspecies variability in morphological characters and limited diagnostic information makes species differentiation of the genus *Omphra* a complicated task. The present study provides a description of a **new species**, *Omphra drumonti* n. sp. from the Western Ghats, redescrptions and a key to the species of *Omphra*, details of intraspecies variation, discussion of relationships between taxa and distributional patterns of the genus. Based on the distributional patterns in the Indian subcontinent and flightlessness of the genus, inability to cross the physical barrier of the Ganges–Brahmaputra delta between north and peninsular India is indicated as the reason for its absence in the northeastern Indian subcontinent and endemism to the lower Indian subcontinent.

Introduction

The tribe Helluonini Hope, 1838 (Coleoptera: Carabidae) is represented by four genera in the Oriental region: *Macrocheilus* Hope, 1838; *Creagris* Nietner, 1857; *Colfax* Andrewes, 1920, and *Omphra* Dejean, 1825 (Sloane 1914; Andrewes 1930; Reichardt 1974). Among the four oriental genera of Helluonini, *Colfax* is distributed between the Indian subcontinent and the Sunda shelf bioregions, *Creagris* between the Indo-Pacific ecoregion and Northern Australia, *Macrocheilus* between the African (Ethiopian–Madagascar) region and Papua New Guinea–Melanesia bioregion, and *Omphra* is limited to the Indian subcontinent bioregion. In addition to its endemism to the Indian subcontinent, *Omphra* is unique for its geophilous habit and winglessness (Sloane 1914; Andrewes 1920, 1930; Reichardt 1974). Since the works on various *Omphra* species by Andrewes (1920, 1921a, 1927, 1930) only the review and key to species by Zhao et al. (2008) provided new details on the taxonomy of *Omphra*. During surveys for surface dwelling arthropods in the Western Ghats, a global hot spot of biodiversity in southwestern India (Myers 2003; Mittermeier et al. 2004), specimens of *Omphra* were commonly found (Vineesh 2007; Sabu et al. 2008; personal observations). Efforts to identify these specimens with the key provided in Zhao et al. (2008) revealed that distinguishing specimens based on pronotal variation is not possible. Further, Zhao et al. did not discuss the high intraspecies variation in several characters: number of setae on the clypeus and mentum, shape of the mentum, and number of tactile setae in elytral intervals. This might have been because of the limited number of specimens available for their analysis.

In the present work, a modified key to the genera of the tribe Helluonini in the Indian subcontinent, a new key to the species of *Omphra* based on elytral characters, description of the species incorporating intraspecies variations, discussions of the relationships between taxa and distribution pattern of the genus in the subcontinent are provided.

Materials and Methods

Specimens were collected with light traps from residential buildings, by hand picking from below stones in agricultural fields and with pitfall traps in rubber plantation and natural forest litter during 2002–2008. Details of the collection methodology employed for specimens from museum depositories are not available. Descriptions of the earlier known species are restricted to diagnostic features not provided in the original descriptions.

Codens of specimen depositories are as follows:

INPC	National Pusa Collection, Indian Agriculture Research Institute, New Delhi, India.
ISNB	Institut Royal des Sciences Naturelles de Belgique, Bruxelles, Belgium.
MNHN	Muséum National d'Histoire Naturelle, Paris, France.
ZMHB	Museum für Naturkunde, Humboldt Universität, Berlin, Germany.
NHMW	Naturhistorisches Museum, Wien, Austria.
ZSIC	Zoological Survey of India, Calicut, India.
SJCC	St. Joseph's College, Calicut, Kerala, India.
TNAU	Tamil Nadu Agricultural University, Coimbatore, India.

Morphological features were compared with types deposited in the collections of various museums (see acknowledgments for details). Specimens were sexed based on the absence or presence of adhesive hairs on protarsi. Total body length was measured from tip of the labrum to apex of the elytra (Lawrence et al. 1999). All measurements are reported in millimeters.

Abbreviations of measurements used in descriptions are as follows:

TL	tip of the labrum to apex of the elytra
TW	broadest body width
PL	length of pronotum along median line
PW	greatest width of pronotum
EL	length of elytra

Taxonomy

Key to the Indian genera of the tribe Helluonini (modified from Sloane 1914)

1. Wingless forms; mentum with a strongly developed stout median tooth; legs stout. ***Omphra* Dejean**
- Winged forms; mentum with an elongated spiniform median tooth; legs slender. **2**
- 2(1). Tarsi with fourth joint deeply bilobed. ***Creagris* Nietner**
- Tarsi with fourth joint entire. **3**
- 3(2). Fourth maxillary palpomere securiform. ***Colfax* Andrewes**
- Fourth maxillary palpomere not securiform. ***Macrocheilus* Hope**

Omphra Dejean, 1825

Omphra Dejean, 1825: 168, 283; Reiche 1843: 330; Lacordaire 1854: 94; Chaudoir 1872: 140; Sloane 1914: 570; Andrewes 1930: 236; Csiki 1932: 1577; Jedlicka 1963: 511; Lorenz 2005: 511; Zhao et al. 2008: 372. Type species: *O. hirta* (Fabricius, 1801).



Figure 1. Distribution of *Omphra* in the Indian subcontinent.

Description. Color. Black or brownish red in color. Ligulae, antennae and palpi brownish red. Body setae black, brownish red or grey in color. Legs black, brownish red or dark red in color.

Head. Convex, narrower than pronotum, widest between eyes, sparsely punctate and setose on frontal foveae and inner side of eyes. Labrum transverse and short, apical margin with 6 setae; with

median emargination, outer apical angles rounded, fine setae present on either side. Clypeus transverse, with 6-9 setae, apical margin emarginated. Frontoclypeal suture faint; frontal foveae depressed and setose; anterior and posterior supraorbital setae present, eye encircled by small setae. Genae slightly convex, asetose; neck glabrous. Mandibles stout, exposed anteriorly, posterior part covered by labrum, scrobe without setae. Mentum round or rectangular in shape, median tooth strongly developed and stout, pointed at apex, triangular, shorter than the lateral lobes, with 1-3 setae; lateral lobes strongly developed, obtuse at apex; base of mentum with 1-2 setae. Ligula small, elongate, tapered towards the apex, sides deeply depressed, with a median longitudinal channel, three pairs of setae present laterally. Palpi short, setose and 4 segmented; 4th palpomere of both maxilla and labium dilated or not dilated, maxillary and labial palpomere 2 as long as 4, 3 shortest. Antenna filiform, setose; scape elongate. Last antennomere oval or elongate oval; antennomeres densely setose from one-third of the base of antennomere 4.

Pronotum. Large, punctate and setose, cordiform, almost round or not, widest at anterior third, strongly convex or slightly convex or not convex or flat; with a distinct shallow median line extending neither to apex nor base. Center area asetose and glossy, densely punctate and setose laterally. Anterior and posterior margins emarginated with a dense fringe of yellow short hairs, anterior and posterior transverse sulci faint; anterior angles round. Lateral margins distinctly or weakly sinuate in front of posterior angles, lateral margin with elongate setae from anterior margin to hind angle. Base narrower than apex, hind angles obtuse, base distinctly emarginate medially.

Scutellum. Large, triangular, pointed, sparsely setose, variably punctate.

Elytra. Longer than pronotum, oval or intermediate between oval and oblong, convex, equal in width or widest before middle; humerus pronounced or not pronounced. Setae grey, black or brownish red. Intervals strongly or weakly convex, with a row of black, brownish red or grey setae along on either side, intervals 3, 5, 7 and 9 with 2-6 randomly located elongate tactile setae; apex straight or obliquely truncate; emarginated or not emarginated. Sutural angle pointed, weakly emarginated, deeply emarginated or not emarginated.

Venter. Sparsely punctate and setose, except posterior area of prosternum and small median area of sternites 3-5. Prosternal process pointed.

Hind wings. Absent.

Legs. Robust, densely setose; tibiae with two elongate spines on apex; claws glabrous.

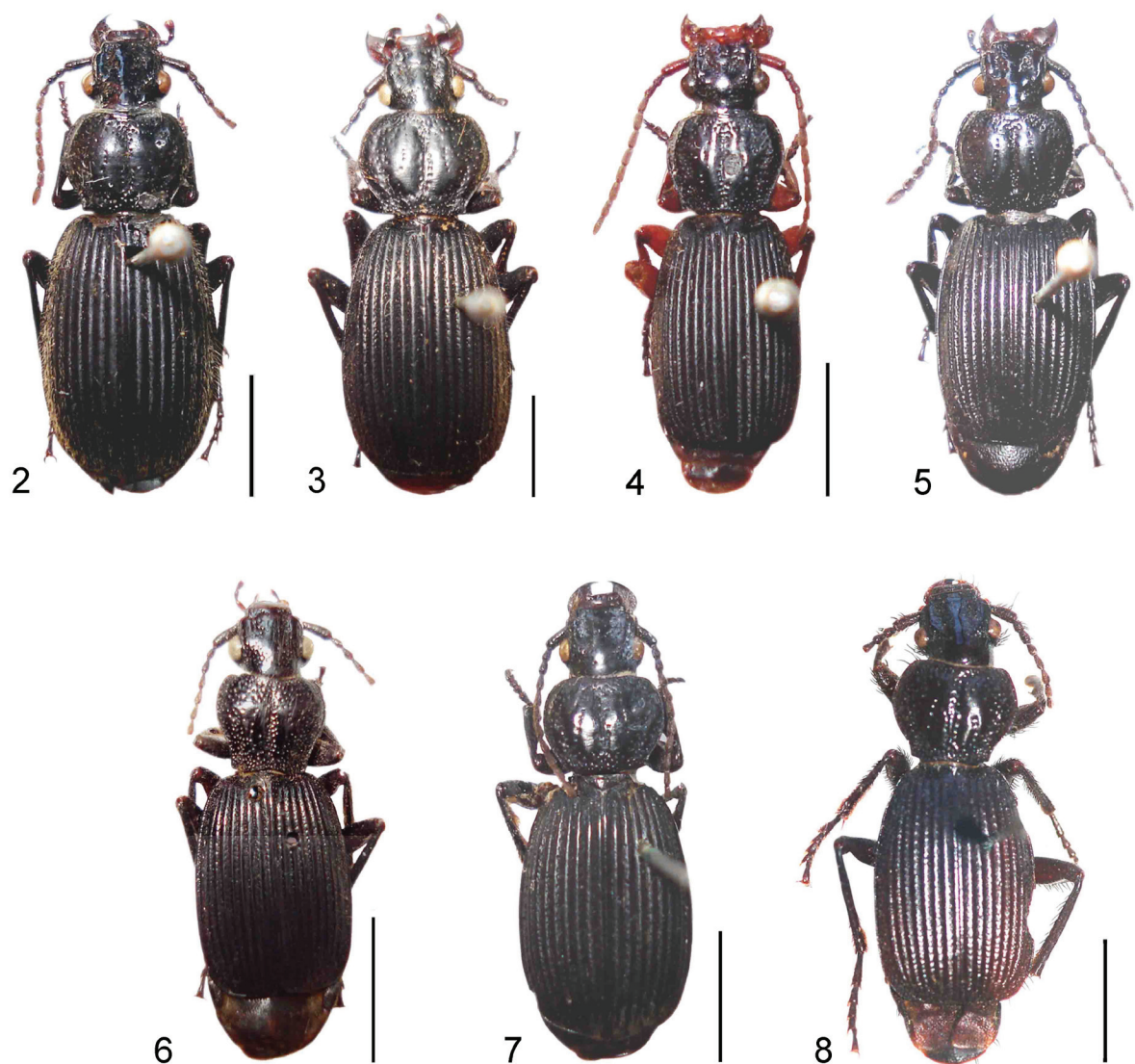
Genitalia. Male: Aedeagus sclerotized; median lobe strong, apical lamella wide or narrower towards apex, pointed or rounded; parameres well developed, lower surface curved; Median lobe of the aedeagus with or without grooves; when present shape of the grooves varies. Female: Sclerotized; stylomere 1 triangular, with or without setae at apical rim; stylomere 2 semilunar in shape, ventrolateral margin slightly serrate with 1-3 very small ensiform setae; stylomere with 2 short setae along the inner margin, placement of these setae varies to the anterior and posterior sides.

Sexual dimorphism. Protarsus of male with and female without asymmetrically arranged dense pads of adhesive squamose setae on ventral surface of three basal tarsomeres.

Geographical distribution. India, Sri Lanka and Nepal

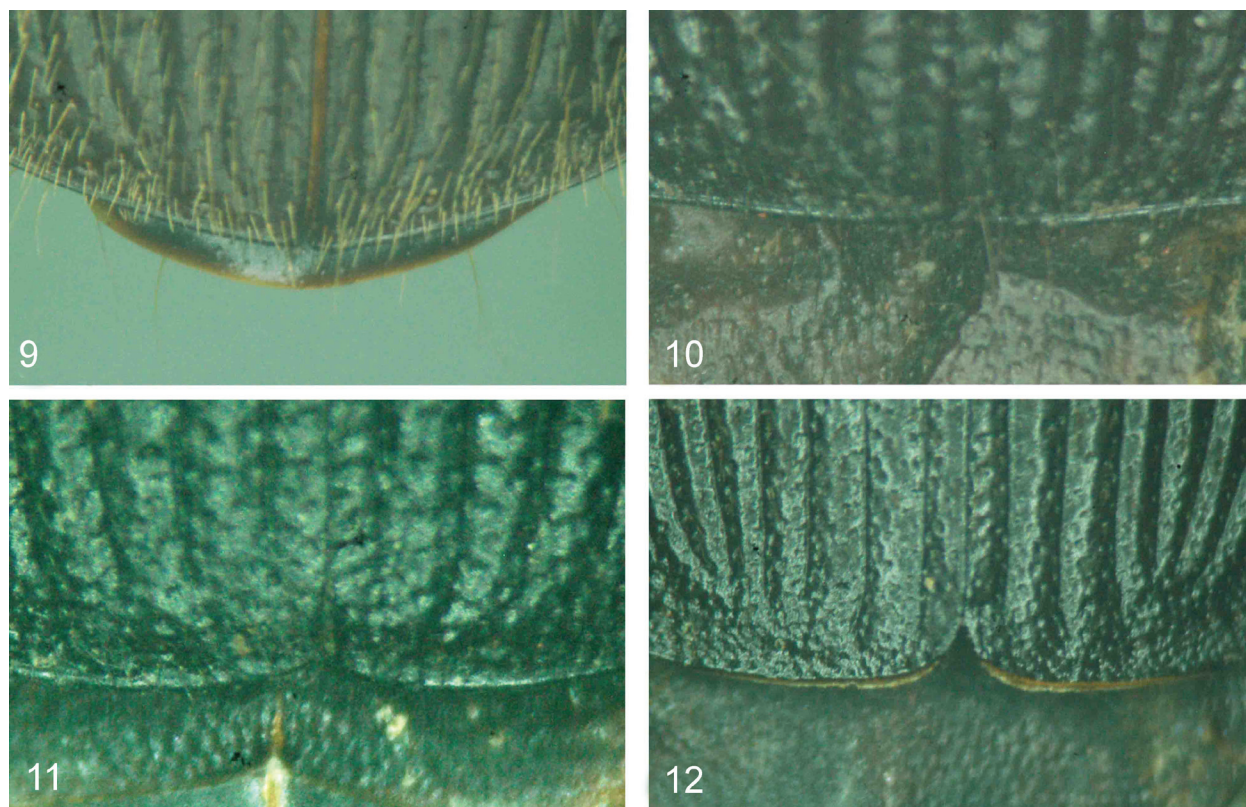
Key to the species of the genus *Omphra*

- | | | |
|-------|--|----------------------------------|
| 1. | Elytral apex obliquely truncate (Fig. 9)..... | 2 |
| — | Elytral apex truncate (Fig. 10)..... | 4 |
| 2(1). | Elytral apex pointed and not emarginated (Fig. 9), elytral setae grey in color..... | 3 |
| — | Elytral apex not pointed and emarginated (Fig. 11), elytral setae black or brownish red in color. | <i>O. pilosa</i> Klug |
| 3(2). | Elytral humerus pronounced (Fig. 2)..... | <i>O. hirta</i> Fabricius |
| — | Elytral humerus not pronounced (Fig. 7). | <i>O. rotundicollis</i> Chaudoir |



Figures 2–8. Habitus of *Omphra* species. 2) *O. hirta* syntype. 3) *O. pilosa* syntype. 4) *O. rufipes* syntype. 5) *O. atrata* syntype. 6) *O. complanata* holotype. 7) *O. rotundicollis* holotype. 8) *O. drumonti* n. sp. holotype.

- 4(1). Elytral apex deeply emarginated (Fig. 12). ***O. complanata* Reiche**
 – Elytral apex weakly emarginated or not emarginated. **5**
- 5(4). Elytral apex weakly emarginated (Fig. 11); pronotum surface flat; legs dark red in color.
 ***O. rufipes* Klug**
 – Elytral apex not emarginated (Fig. 10); pronotum surface convex; legs black or reddish brown
 in color. **6**
- 6(5). Elytral humerus not pronounced (Fig. 8); anterior margin of abdominal sternites yellowish red
 and posterior margin dark red in color (Fig. 15); pronotum strongly convex.....
 ***O. drumonti* n. sp.**
 – Elytral humerus pronounced (Fig. 5); anterior margin of abdominal sternites brownish red;
 pronotum slightly convex. ***O. atrata* Klug**



Figures 9–12. Elytral apex. **9)** Pointed and not emarginate. **10)** Straight and not emarginate. **11)** Oblique and weakly emarginate. **12)** Straight and deeply emarginate.

***Omphra hirta* (Fabricius, 1801)**

Figures 2, 9, 14

Omphra hirta (Fabricius); Reiche 1843: 330; Motschulsky 1855: 54; Redtenbacher 1867: 5; Bates 1891: 336; Andrewes 1921(a): 163; 1923: 460; 1930: 237; Csiki 1932: 1578; Lorenz 2005: 511; Zhao et al. 2008: 372.

Helluo hirtus (Fabricius); Klug 1834: 71; Hope 1838: 98.

Galerita hirta Fabricius, 1801: 214; Latreille and Dejean 1824: 954; Dejean 1825: 284.

Carabus rufitarsis Illiger, 1802: 164.

Description. Color. Dorsal side black, ventral side black or brownish red; labrum and mentum brownish red; legs black or brownish red. Dorsal and ventral body setae grey in color.

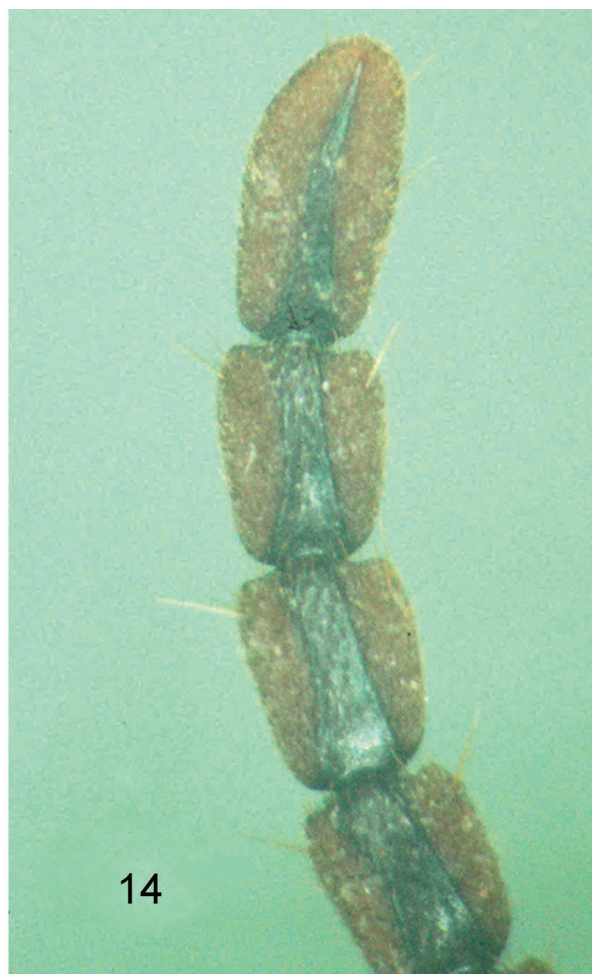
Head. Labrum transversely extended or not; clypeus with 6-9 setae. Mentum round or rectangular in shape; median tooth with 1-2 setae, base of mentum with 2 setae. 4th palpomere of labium and maxilla dilated. Last antennomere elongate oval.

Pronotum. Slightly convex, almost rounded, widest at middle. Lateral margins strongly sinuate to base.

Scutellum. Sparsely punctate.

Elytra. Oval, widest in middle. Humerus pronounced. Intervals weakly convex. Apex obliquely truncate, pointed without emargination.

Genitalia. Male: Apical lamella of aedeagus narrow and pointed at apex. Female: Stylomere 1 without setae at apical rim; stylomere 2 with two setae at ventro-lateral margin.



Figures 13–14. Last antennomere 13) oval and 14) elongate oval.

Measurements. Male (n=10), TL= 13.0 and 17.0, TW= 4.7 and 6.4, PL= 2.8 and 3.8, PW= 3.7 and 4.8, EL= 7.0 and 10.0. Female (n=10), TL= 15.0 and 18.0, TW= 6.0 and 6.6, PL= 3.3 and 3.5, PW= 4.5 and 4.7, EL= 8.0 and 10.0.

Specimens examined (n=99). Syntypes. INDIA: Eastern India, No. 574, 6 males, 1 female (ZMHB); Eastern India, Coll. Chaudoir from Coll. Dejean, 7 males, 4 females (MNHN); SRI LANKA: No. 574, 1 male (ZMHB). INDIA: Tamil Nadu, Courtalam, 1-5.111-27, P.V. Issac, det. H.E. Andrewes, 1918, 1 sex undetermined (INPC); SRI LANKA: Novara, 1857-59, Reise, 1 male (NHMW); Locality unknown, 1 male (NHMW). INDIA: Bengale, Coromandel, Genji, 6-8.1903, R.P. Autemard, 3 males, 1 sex undetermined; Bengale, Coromandel, Genji, Coll on Le Moult, Natuaraliste, Paris, coll. M, 9 males, 11 females, 1 sex undetermined; Tamil Nadu, Shanbaganur, Coll on Le Moult, Natuaraliste, Paris, Coll. M, 1 female; St. Thomas Mount, XII-1950, P. Susai Narhan I.G. 17816, 1 male, 4 females; Trichinopoly [=Thiruchirappally], 1905, Leg. R.P. du Breuil, 11 males, 8 females, 14 sex undetermined; Trichinopoly, Coll on Le Moult, Natuaraliste, Paris, Coll. M., 2 males; Trichinopoly, R.P. Castels, 1905, 7 males, 1 female, 2 sex undetermined; Deccan, Kwiduwadi, x-xi-1946, Dr. Lindberg, I.G. 16.722, 1 sex undetermined (ISNB).

Distribution. India and Sri Lanka.

Remarks. *Omphra hirta* is most similar to *O. rotundicollis* by having grey colored body setae and pointed elytral apex. It is distinguishable from *O. rotundicollis* with pronounced elytral humerus.

***Omphra pilosa* (Klug, 1834)**

Figures 3, 11, 14

Omphra pilosa (Klug); Reiche 1843: 330; Erichson 1847: 141; Redtenbacher 1867: 5; Chaudoir 1872: 141; Putzeys 1875: 45; Andrewes 1921(a): 163; 1923: 460; 1927: 101; 1930: 237; Csiki 1932: 1578; Jedlicka 1963: 512; Lorenz 2005: 511; Zhao et al. 2008: 371.

Helluo pilosus Klug, 1834: 71.

Galerita attelaboides Fabricius, 1801: 214; Schaum 1847: 49; 1848: 334; Motschulsky 1855: 54.

Description. Color. Dorsal and ventral sides black; labrum and mentum black or brownish red, coxae and trochanter brownish red, legs black. Setae black in color.

Head. Labrum transversely not extended. Clypeus with 6-8 setae. Mentum oval and rectangular, median tooth with 2 setae, base with 2 setae. Last maxillary and labial palpomere dilated. Last antennomere elongate oval.

Pronotum. Strongly convex, entirely rounded, widest in middle. Lateral margins strongly sinuate to base. Base slightly emarginate laterally.

Scutellum. Sparsely or densely punctate.

Elytra. Elongated oval, widest behind the middle. Humerus not pronounced. Intervals strongly convex, apical margin obliquely truncated with weak emargination.

Genitalia. Male: Apical lamella wide and rounded at apex. Female: Stylomere 1 setose at apical rim; stylomere 2 with one setae at ventro-lateral margin.

Measurements. Male (n=10), TL = 14.0 and 17.0, TW = 4.9 and 6.1, PL = 3.3 and 3.9, PW = 4.0 and 5.1, EL = 8.0 and 10.0. **Female (n=5),** TL = 14.0 and 17.0, TW = 5.7 and 6.9, PL = 3.4 and 3.9, PW = 4.2 and 5.0, EL = 7.5 and 10.0.

Specimens examined (n=134). Syntypes. INDIA: Eastern India, No. 575, 1 male, 3 females (ZMHB); Eastern India, 3 males, 2 females (MNHN); SRI LANKA: 1 female (Holotype of *O. attelaboides*), No. 575 (ZMHB). SRI LANKA: Hikkaduwa, IV. 1984, E. Kirschenhofer, H. E. Andrewes, 1 male (NHMW); IV. 99, L. Magnus, det. H. E. Andrewes, 1 male (NHMW); INDIA: Maharashtra, Bombay, No. 10, under stones, C/8311, det. H. E. Andrewes, 1920, unknown collector, 1 sex undetermined (INPC). INDIA: Kerala, Arakkulam, 17.IV.2006, Sabu K.T., 2 males, 1 female; Calicut, 5-XI-2007, Basheer M., 21 males, 14 females; Chemperi, 03.IV.2006, Vineesh P.J., 1 male; Chinnar, 26.I.2008, Sabu K.T. 16 males, 2 females; Chinnar, 02.07.2007, Shiju T.R., 5 males, 4 females; Karimutti, 26.I.2008, Shiju T.R., 2 females; Kuttiyadi, 05.IX.07, Basheer M., 1 female; Malappuram, 02.V.06, Vinod K.V., 1 female; Thodupuzha, 17.IV.2006, Sabu K.T., 4 females; (SJCC). Calicut, 15.X.2007, Sabu K.T., 3 males, 4 females (TNAU); Calicut, Shiju T.R. 6 males, 5 females (ZSIC); Malabar, unknown collector, 7 males, 3 females; Mahe, Cote de Malabar, Julliet, 1901, M. Maindron, 3 male, 1 female; Hindustan, Mahe, Malabar Coll on Le Moul, Natuaraliste, Paris, Coll. M., 9 males, 1 female, Tamil Nadu, Madras, Collection P. Dupuis, 1 male; Uthar Pradesh, Haridvar, P. Dupuis, 1 female; Bengal, P. Dupuis, 1 male; Inde, unknown collector, 1 male; ex coll. Bonneuil, 1 female (ISNB).

Distribution. India and Sri Lanka.



Figure 15. Color pattern of sternites of *Omphra drumonti* n. sp.

Remarks. *Omphra pilosa* is most similar to *O. hirta* and *O. rotundicollis* with obliquely truncate elytral apex. It is easily distinguished from *O. hirta* and *O. rotundicollis* by its black elytral setae and unpointed, emarginated elytral apex.

***Omphra rufipes* (Klug, 1834)**

Figures 4, 10, 14

Omphra rufipes (Klug); Reiche 1843: 330; Chaudoir 1872: 141; Bates 1886: 200; Andrewes 1927: 101; 1930: 237; Csiki 1932: 1578; Lorenz 2005: 511; Zhao et al. 2008: 371.

Helluo rufipes Klug, 1834: 72.

Description. Color. Dorsal and ventral sides black; labrum and mentum brownish red, legs dark red. Dorsal and ventral body setae black or brownish red.

Head. Labrum transversely not extended; clypeus with 6-9 setae. Mentum round or rectangular; median tooth and base of mentum with 2 setae. 4th palpomere of labium and maxilla dilated. Last antennomere elongate oval.

Pronotum. Flat, widest in or before middle; not round, punctures more dense on basal area than on lateral area. Lateral margins weakly sinuate to base, base distinctly emarginate laterally.

Scutellum. Densely punctate.

Elytra. Not oval, widest behind middle. Humerus pronounced. Intervals strongly or weakly convex. Apex truncate with a weak emargination.

Genitalia. Male: Apical lamella wide and rounded at apex. Female: Stylomere 1 without setae at apical rim; stylomere 2 with two setae at ventro-lateral margin

Measurements. Male (n=1), TL = 16.0, TW = 5.7, PL = 3.5, PW = 4.5, EL = 9.0. **Female (n=2),** TL = 15.0 and 16.0, TW = 5.6 and 5.9, PL = 3.4 and 3.6, PW = 4.3 and 4.5, EL = 9.0 and 9.0.

Specimens examined (n=11). Syntypes. INDIA: Eastern India, No. 577, 1 male (ZMHB); SRI LANKA: Coll. Chaudoir, 2 males, 2 females (MNHN); Puwakpitiya Ceylon, Hiver 1906-07, E. Bugnion, 1 male, 1 female (MNHN); Ceylon S., Welioama, Coll. I.B.F., 1 female (MNHN). SRI LANKA: Sigiriya, Okt, 1977, unknown collector, 1 male (NHMW). SRI LANKA: Kandy Ceylon, 1905, R. P. Gilles, 2 females (ISNB).

Distribution. India and Sri Lanka.

Remarks. *Omphra rufipes* is most similar to *O. complanata*, its bright red colored legs, flat pronotum, weakly emarginated elytral apex, elongate oval last antennomere and dilated 4th palpomeres makes it distinct from *O. complanata*.

***Omphra atrata* (Klug, 1834)**

Figures 5, 10, 14

Omphra atrata (Klug); Reiche 1843: 330; Andrewes 1921(b): 346; Chopra 1924: 145; Andrewes 1927: 101; 1930: 236; Csiki 1932: 1577; Lorenz 2005: 511; Zhao et al. 2008: 371.

Helluo atratus Klug, 1834: 72.

Description. Color. Dorsal side black, ventral side brownish red. Labrum and mentum brownish red, coxae and trochanter black or brownish red, legs black. Dorsal and ventral body setae black or brownish red.

Head. Labrum transversely not extended. Clypeus with 6-8 setae. Mentum rectangular; median tooth with 3 setae, base of mentum with 4 setae. 4th palpomere of labium and maxilla dilated. Last antennomere elongate oval.

Pronotum. Slightly convex, widest before or behind middle. Lateral margin weakly sinuate towards base.

Scutellum. Not punctate.

Elytra. Elongate oval, widest behind middle. Humerus pronounced. Intervals weakly convex. Apex truncate, without emargination.

Genitalia. Male: Apical lamella of aedeagus narrow and pointed at apex. Female genitalia unknown.

Measurements. Male (n=5), TL = 14.0 and 15.0, TW = 4.9 and 5.3, PL = 3.1 and 3.3, PW = 3.8 and 4.1, EL = 8.0 and 9.0.

Specimens examined (n=5). Syntypes. INDIA: West Bengal, No. 576, 1 male (ZMHB); INDIA: Deccan, Coll. Chaudoir ex coll. Reiche, 1 male (MNHN); Eastern India, ex coll. Chaudoir, 1 male (MNHN). INDIA: West Bengal, the number 576, 1 male (ZMHB). Locality unknown, Collect. Plason. 1 male (NHMW).

Distribution. India.

Remarks. *Omphra atrata* is most similar to *O. drumonti* n. sp. having truncate and not emarginated elytral apex. It is distinguished from *O. drumonti* n. sp. by the presence of a slightly convex pronotum, pronounced elytral humerus and reddish brown anterior margin the of abdominal sternites.

***Omphra complanata* Reiche, 1843**

Figures 6, 12, 13

Omphra complanata Reiche, 1843: 342; Chaudoir 1872: 141; Andrewes 1921(b): 345; 1930: 236; Csiki 1932: 1578; Lorenz 2005: 511; Zhao et al. 2008: 370.

Omphra brevis Chaudoir, 1850: 36.

Description. Color. Dorsal side black, ventral side black or brownish red; mentum, coxae and trochanters brownish red, labrum and legs are black or brownish red. Setae brownish red.

Head. Labrum transversely not extended; clypeus 3-5 setose. Mentum round or not rounded in shape; median tooth with 3 setae, base of mentum with 6 setae. 4th palpomere of labium and maxilla not dilated. Last antennomere oval.

Pronotum. Slightly convex, more convex at apical one-third; widest before or behind middle. Lateral margins weakly sinuate to base, base distinctly emarginate laterally.

Scutellum. Sparsely or densely punctated.

Elytra. Not oval, widest behind middle. Humerus pronounced. Intervals weakly convex. Apex truncate with a deep emargination.

Genitalia. Male: Apical lamella of aedeagus narrow and pointed at apex. Female: Stylomere 1 without setae at apical rim; stylomere 2 with two setae at ventro-lateral margin.

Measurements. Female (n=10), TL = 13.0 and 14.0, TW = 5.0 and 5.2, PL = 2.9 and 3.1, PW = 3.6 and 4.0, EL = 7.0 and 8.0.

Specimens examined (n=14). Holotypes. INDIA: Deccan, Coll. Chaudoir ex coll. Reiche, 1 male; East India, (Holotype of *O. brevis* Chaudoir), Coll. Chaudoir ex coll. Reiche, 1 male (MNHN). NEPAL: Janakpur, P.G.P. C/8304, det. H. E. Andrewes 1916, unknown collector, 1 sex undetermined (INPC). INDIA: Tamil Nadu: Pondichery, det. H. E. Andrews, unknown collector, 7 females; Pondichery, G. Fangel, 1 sex undetermined; Maharashtra, Sangli, Colln. P. Dupuis, det. P. Dupuis, 2 females; 1920, P. Dupuis, det. H. E. Andrews, 1 female; (ISNB).

Distribution. India and Nepal

Remarks. The deep emargination of the elytral apex makes *O. complanata* distinct from all other species.

***Omphra rotundicollis* Chaudoir, 1872**

Figures 7, 9, 14

Omphra rotundicollis Chaudoir, 1872: 140; Andrewes 1930: 237; Csiki 1932: 1578; Lorenz 2005: 511; Zhao et al. 2008: 369.

Description. Color. Dorsal side black, ventral side brownish red; labrum, mentum and legs brownish red. Dorsal and ventral body setae grey.

Head. Labrum transversely not extended; clypeus 2-6 setose. Mentum round in shape, median tooth with 2 setae, base of mentum with 3 setae. Last maxillary and labial palpomere dilated. Last antennomere elongate oval.

Pronotum. Strongly convex, not rounded or wholly rounded, widest in middle or apical one-third. Lateral margins weakly sinuate in front of posterior angles, base weakly emarginate laterally.

Scutellum. Densely or sparsely punctated.

Elytra. Not oval, widest after middle; humerus not pronounced; intervals weakly convex. Apex obliquely truncate, without emargination.

Genitalia. Male: Apical lamella wide or narrow; pointed or rounded at apex. Female: Stylomere 1 without setae at apical rim; stylomere 2 with two setae at ventro-lateral margin.

Measurements. Male (n=7), TL = 14.0 and 17.0, TW = 5.0 and 5.7, PL = 3.2 and 3.7, PW = 3.9 and 4.5, EL = 8.0 and 10.0. **Female (n=3),** TL = 15.0 and 18.0, TW = 5.5 and 6.0, PL = 3.5 and 3.8, PW = 4.1 and 4.7, EL = 8.0 and 10.0.

Specimens examined (n=110). Holotype. INDIA: Eastern India, Coll. Chaudoir ex coll. Dejean, 1 female (MNHN). Madura, Zolyndicottes, ex. coll. Courgouin, det. H.E. Andrewes, 1 male; Sco. Ent. Belg., Coll. Putzeys, det. H.E. Andrewes, 1 sex undetermined. INDIA: Bengale, Coromandel, Genji, Coll on Le Moul, Natuaraliste, Paris, Coll. M, 8 males, 2 females, 2 sex undetermined; Coromandel, Genji, 6-8, 1903, R.P. Autemard, 4 males, 3 females, 1 sex undetermined; Coromandel, Genji, Coll on Le Moul, Natuaraliste, Paris, Coll. M, 3 males, 1 female; Tamil Nadu, Trichinopoly [=Thiruchirapally], 1905, Leg. R.P. du Breuil, 37 males, 21 females, 18 sex undetermined; Trichinopoly, R.P. Castels, 1905, 2 males; Shanbaganur, Coll on Le Moul, Naturaliste, Paris, Coll. M, 1 female; St. Thomas Mount, XII-1950, P. Susai Narhan I.G. 17816, 1 male, 1 female; Madurai, unknown collector, 1 male; Madurai, Collection E. Rousseau, 1 sex undetermined (ISNB).

Distribution. India.

Remarks. *Omphra rotundicollis* is most similar to *O. hirta* with grey colored body setae and pointed elytral apex. The less pronounced elytral humerus distinguishes it from *O. hirta*.

***Omphra drumonti* n. sp.**

Figures 8, 10, 15

Description. Color. Dorsal and ventral side of the body brownish red; anterior margin of sternites distinctly yellowish red, middle region and posterior margin black.

Head. Large, slightly narrower than pronotum, widest between eyes, moderately setose and punctate. Antenna elongate, filiform, setose, scape elongate, terminal antennomeres of the unique holotype is broken off. Clypeus transverse, anterior margin straight, frontoclypeal suture faintly rounded, with a depression at anterior side, 3 setae on each side, and elevated in the middle. Frons punctate, frontal foveae setose and depressed, middle region and sides elevated and glabrous. Vertex punctate and setose at the sides, glabrous at middle. Eyes big, semicircular, laterally well projected, supraorbital and suborbital region setose and punctate. Occiput strongly convex and glabrous. Labrum transverse and short, brownish red, apical margin emarginate, slightly round, 6 setae along apical margin, outer apical angles rounded with setae. Labial and maxillary palpomeres broken off. Mandibles simple, strongly arcuate, exposed, apex acuminate, slightly asymmetrical. Ligula wide, deeply depressed at sides, with a deep longitudinal central channel, apex rounded and pale red, two pairs of setae on each side of the channel close to apex. Lacinia, galea, glossa and paraglossa not visible. Mentum with one pair of setae on each side of base, median tooth strongly developed and stout, triangular, shorter than lateral lobes, base with one setae on each side, lateral lobes strongly developed and stout, pointed at apex. Submentum transverse, narrow, two setae present near middle. Gula narrow, glabrous, slightly convex, smooth and glossy. Two deep punctures present at the joining of submentum and gula. Genae punctate, smooth and convex.

Pronotum. Strongly convex, large and wide, almost round, widest in middle, apical and basal margin not straight, both apical and basal margins with a dense fringe of short setae, punctures dense on lateral area, lateral margin rounded anteriorly, sinuate close to base, without marginal border, median line well developed and a row of punctures present on both sides, apical and basal line faint and covered with dense punctures; central portion of pronotum glossy and with a few punctures, sides of basal margin emarginated, anterior angles rounded. Lateral margins bordered, sinuate near base, elongate setae present; base narrower than apex, hind angles nearly obtuse. Ventral side of pronotum brownish red, proepisternum densely punctate and pilose, proepimeron impunctate, prosternal process sparsely punctate and with a bunch of elongate setae on the apex.

Scutellum. Asetose, sparsely punctate.

Elytra. Elongate, twice as long as pronotum, lateral margins subparallel; humerus pronounced, setose, rounded, without tooth. Surface glossy and densely punctate. Intervals gently convex, regularly and densely pilose with two rows of short black setae, interval 7 with 2 elongate setae. Lateral margins bordered, with elongate setae; apical margin truncate, without emargination, elongate setae present at apical margin.

Hind wings. Absent.

Legs. Stout and elongate and densely setose, dark red.

Venter. Elongate setae present on lateral margins, anterior margin of sternites yellowish red and posterior margin dark red, 5th and 6th abdominal sternite with two elongate setae in the middle.

Genitalia. Male: unknown. Female: genitalia broken off.

Measurements. Female (Holotype), TL = 18.0, TW = 5.6, PL = 3.9, PW = 5.6, EL = 10.0.

Type material (n=1). Holotype, INDIA. Tamil Nadu: Kodicanal (=tropical montane evergreen forest ecoregion of the Western Ghats at Kodaikanal), R. Mus. Hist. Nat. Belg. I.G. 12.595, unknown collector, 1 female (ISNB). Labial and maxillary palpi and last antennomeres are broken off.

Geographical distribution. South India

Etymology. Species is named for Mr. Alain Drumont (ISNB, Bruxelles, Belgium), whose generous help enabled the present study.

Remarks. *Omphra drumonti* is most similar to *O. atrata* having truncate and in lacking an emarginated elytral apex. It is distinguishable from *O. atrata* by the presence of a strongly convex pronotum, less pronounced elytral humerus and distinct yellowish red anterior margin of the abdominal sternites. *Omphra drumonti* is distinct from *O. complanata* and *O. rufipes* in the absence of emarginated elytral apex; further it differs from *O. complanata* in the possession of an elongated oval last antennomere and dilated 4th palpomere in contrast to the oval last antennomere and undilated 4th palpomere. *Omphra drumonti* differs from *O. rufipes* in having a convex pronotum and brownish red legs in contrast to the flat pronotum and bright red legs in *O. rufipes*.

Discussion

Aptery and the occurrence of a short median tooth on the mentum renders *Omphra* distinct from the other three Oriental helluonine genera namely, *Macrocheilus*, *Colfax* and *Creagris*. However, morphological affinities of *Omphra* with *Macrocheilus* (larger body size, simple 4th tarsomeres; longer legs; non-securiform labial palpomere) and the distinct differences from *Colfax* (smaller body size, short legs, securiform labial palpomere) and *Creagris* (bilobed 4th tarsomere; smaller body size, short legs) suggest that *Omphra* and *Macrocheilus* are closely related. These observations raise the question, which *Omphra* species is the most plesiomorphic.

The absence of any *Omphra* species in northeastern part of the subcontinent and beyond in southeastern Asia and its present status as endemic to the Indian subcontinent is attributed to the physical barrier to dispersal for terrestrial biota (Pawar et al. 2007; Chatterjee 2008; Field et al. 2007) by the Ganges–Brahmaputra delta (Fig. 1).

The origin of a flightless species from a flighted ancestor requires isolation in a resource rich protected environment and reduced necessity of wings (Roff 1990). Hence it is likely that the abundance of

the preferred prey resources namely ground surface dwelling ants and termites (Prasad and Rajagopal 1990), subterranean habits of living in small burrows under large stones (second author-personal observations) and protection by the odoriferous defense gland secretions might have allowed flightlessness to evolve in *Omphra*. Aptery has been accompanied by cursorial adaptations, namely, elongated and strong legs in contrast to the slender and weak legs in other oriental helluonine genera, short median tooth of mentum and protruding mandibles for the partly subterranean way of life. The habit of storing dead ants in burrows for later use (Prasad and Rajagopal 1990), protection by the odoriferous defense gland secretions, cursorial adaptations, ability to live in burrows under rocks and idleness when faced with danger, might have contributed to the wider establishment of *Omphra* than the macropterous genera of the tribe (*Macrocheli*us, *Colfax* and *Creagris*) in the subcontinent.

Acknowledgments

Financial assistance provided by UGC (University Grants Commission, India) to the first author is gratefully acknowledged. We are indebted to A. Drumont (ISNB, Bruxelles, Belgium) for facilitating the study. We thank T. Deuve (Muséum National d'Histoire Naturelle, Paris, France); M. Uhlig and L. Jaeger (Museum für Naturkunde, Humboldt Universität, Berlin, Germany); H. Schillhammer (Natural History Museum, Vienna, Austria); O. Merkl (Hungarian Natural History Museum, Budapest, Hungary); W. Lorenz (Tutzing, Germany); V.V. Ramamurthy (Indian Agricultural Research Institute, New Delhi, India); R. Radhakrishnan (ZSIC, Western Ghats Field Research Station, Calicut, India) and S. Nampy (St. Joseph's College, Devagiri, Calicut) for their generous help in innumerable ways to study the ground beetles of the region. We thank W. Lorenz (Faunistics and Environmental Planning, Germany), Tian M. (Department of Entomology, South China Agricultural University, Guangzhou, China) and J.E. Hogan (Hope Entomological Collections, Oxford University Museum of Natural History, United Kingdom) for critical comments. We are grateful to the Kerala Forest and Wild Life Department for permissions; members of Vazhacharickal family (Arakulam) for providing collections from their plantations, and P. Abhitha and K.V. Vinod (St. Joseph's College, Devagiri, Calicut) for the logistical support.

Literature Cited

- Andrewes, H. E. 1920.** Papers on Oriental Carabidae-VI. The Annals and Magazine of Natural History 9(36): 493-506.
- Andrewes, H. E. 1921a.** Notes on synonymy and on some types of Oriental Carabidae in various foreign collections. The Transactions of the Entomological Society of London 3: 145-195.
- Andrewes, H. E. 1921b.** The Carabidae of Barkuda Island. Records of the Indian Museum 4(22): 339-348.
- Andrewes, H. E. 1923.** On the types of Carabidae described by Schmidt-Goebel. The Transactions of the Entomological Society of London 71(1-2): 1-65.
- Andrewes, H. E. 1927.** Papers on Oriental Carabidae-XIX. The Annals and Magazine of Natural History 9(19): 97-111.
- Andrewes, H. E. 1930.** Catalogue of Indian insects (Part 18: Carabidae). Government of India Central Publication Calcutta; Calcutta 389 p.
- Bates, H. W. 1886.** On the geodephagous Coleoptera collected by Mr. George Lewis in Ceylon. The Annals and Magazine of Natural History 5(17): 199-212.
- Bates, H. W. 1891.** List of the Carabidae (Ord. Coleoptera) obtained by père Cardon in Chota-Nagpore. Annales de la Société Entomologique de Belgique, Comptes-Rendus des Séances 35: 324-340.
- Chatterjee, S. 2008.** Biodiversity conservation issues of northeast India. International Forestry Review 10(2): 315-324.
- Chaudoir, M. de. 1850.** Mémoire su la famille des Carabiques. Extraits du Bulletin de la Société Impériale des Naturalist de Moscou 23: 3-196.
- Chaudoir, M. de. 1872.** Descriptions d'espèces nouvelles de Carabiques de la tribu des Troncatipennes, et remarques synonymiques. Revue et Magasin de Zoologie pure et Appliquée 2(23): 138-143.
- Chopra, B. 1924.** The larva of an Indian carabid beetle. Records of Indian Museum 26: 145-151.
- Csiki, E. 1932.** Carabidae: Harpalinae VII (Pars 124). Coleopterorum Catalogus 3(3): 1279-1598.

- Dejean, P. F. M. A. 1825.** Spécies général des Coléoptères de la collection de M. le comte Dejean. Tome premier. Chez Crevot, Libraire-Editeur; Paris. 463 p.
- Erichson, 1847.** Einige Erörterungen zu den Bemerkungen über Fabricische Käfer. Entomologische Zeitung, Stettin 8: 141-142.
- Fabricius, J. C. 1801.** Systema Eleutheratorum secundum ordines, genera, species; adiectis synonymis. Locis, observationibus, descriptionibus. Bibliopoli Academici Novi; Kiel. 506 p.
- Field, J. S., D. M. Petraglia, and M. M. Lahr. 2007.** The southern dispersal hypothesis and the South Asian archaeological record: Examination of dispersal routes through GIS analysis. Journal of Anthropological Archaeology 26: 88-108.
- Hope, F. W. 1838.** The coleopterist's manual, part II. Henry G. Bohn; London. 168 p.
- Illiger, J. K. W. 1801.** Neue Insekten. Magazin für Insektenkunde 1: 163-208.
- Jedlicka, A. 1963.** Monographie der Truncatipennen aus Ostasien. Lebinnæ-Odacanthinae-Brachyninae-Carabidae. Entomologische Abhandlungen und Berichte aus dem Staatlichen Museum Für Tierkunde in Dresden 28: 269-578.
- Klug, J. C. F. 1834.** Bebersicht der Carabici der Sammlung. Jahrbücher der Insectenkunde, mit besonderer Rücksicht auf die Sammlung im Königi. Museum zu Berlin; Berlin. 396 p.
- Lacordaire, J. T. 1854.** Genera des coléoptères, ou exposé méthodique et critique de tous les genres proposés jusqu'ici dans cet orde d'insectes. Histoire Naturelle des Insectes. Coléoptères 1: 1-486.
- Latreille, P. A., and P. F. M. A. Dejean. 1824.** Histoire Naturelle et Iconographie des Insectes, Coléoptère d'Europe, Chez Crevot, Libraire-Editeur; Paris. 198 p.
- Lawrence, J. F., A. M. Hastings, M. J. Daiiwitz, T. A. Paine, and E. J. Zurcher. 1999.** Beetles of the World. CSIRO Publishing. [CD-ROM publication]
- Lorenz, W. 2005.** Systematic list of extant ground beetles of the world. Tutzing: Published by the author; Tutzing. 530 p.
- Mittermeier, R. A., P. Robles-Gil, M. Hoffmann, J. D. Pilgrim, T. M. Brooks, C. G. Mittermeier, J. L. Lamoreux, and G. Fonseca. 2004.** Hotspots revisited: Earth's biologically richest and most endangered terrestrial ecoregions. CEMEX; Mexico City. 390 p.
- Motschulsky, V. de. 1855.** Sur les collections Coléoptérologiques de Linné et de Fabricius. Etudes Entomologiques 4: 25-72.
- Myers, N. 2003.** Biodiversity hotspots revisited. Bioscience 53: 916-917.
- Nietner, J. 1857.** On new Ceylon Coleoptera. The Annals and Magazine of Natural History 20(2): 277-279.
- Prasad, K., and D. Rajagopal. 1990.** Carabid beetle, *Omphra pilosa* Klug (Coleoptera: Carabidae) a potential predator on termites. Journal of Biological Control 4(2): 105-108.
- Pawar, S. S., A. C. Birand, M. F. Ahmed, S. Sengupta, and T. R. S. Raman. 2007.** Conservation biogeography in Northeast India: hierarchical analysis of cross-taxon distributional congruence. Diversity and Distributions 13: 53-65.
- Putzeys, J. A. A. H. 1875.** Notes sur les Carabiques recueillis par M. Jean Van Volxem a Ceylan, a Manille, en Chine et au Japon (1873-1874). Annales de la Société Entomologique de Belgique 18: 45-55.
- Redtenbacher, L. 1867.** Zoologischer Theil. Zweiter Band. I. Abtheilung A.I. Coleoptera. Reise der Österreichischen Fregatte Novara un die Erde in den Jahren 1857, 1858, 1859 unter der befehlen des Commodore B. von Wüllerstorff-Urbair. Karl Gerold's Sohn; Wien. 249 p.
- Reichardt, H. 1974.** Monograph of Neotropical Helluonini (Coleoptera: Carabidae Studia Entomologica. Revista International de Entomologia, Brazil XVII: 211-302.
- Reiche, M. 1843.** Recherches sur les Helluonides, ou Révision du genre *Helluo*, Bonelli et Dejean. Annales de la Société Entomologique de France 11[1842]: 323-344.
- Roff, D. A. 1990.** The evolution of flightlessness in insects. Ecological Monographs 60: 389-422.
- Sloane, T. G. 1914.** Revisional notes on Australian Carabidae, part V. The Proceedings of the Linnean Society of New South Wales 39(3): 568-614.
- Schaum, H. 1847.** Bemerkungen über Fabricische Käfer. Entomologische Zeitung, Stettin 8: 39-57.
- Schuam, H. 1848.** Nachträge und Berichtigungen zu einigen fruheren Aufsätzen. Entomologische Zeitung, Stettin 9: 333-338.

- Vineesh, P. J. 2007.** Ecology and diversity of entomofauna in the litter stands of monoculture and natural forests in Kannur district (Ph.D. Thesis). University of Calicut; Calicut. 184 p.
- Zhao, D., T. Deuve, and M. Tian. 2008.** A review of the genus *Omphra* Reiche (Coleoptera: Carabidae: Helluonini). *Oriental Insects* 42: 367-378.

Received July 3, 2011; Accepted October 25, 2011.